In The Claims

Claim 13 has been amended as follows:

13. (Amended) A thermal bubble inkjet head having symmetrical heaters and a rapid ink refill mechanism according to claim 11, wherein said inkjet orifice is formed in close proximity to said two spaced-apart heaters.

REMARKS

Thorough examination and careful review of the application by the Examiner is noted and appreciated.

The Applicants hereby affirm an election made by the Applicants' representative during a telephone conversation with the Examiner on June 26, 2002 of a provisional election to prosecute the invention of Group II, species I, claims 11-20.

Claims 11-20 are pending in the application. Claims 11-20 stand rejected.

Objection To The Drawings

The drawings are objected to by the Examiner as showing reference numerals 26 and 35 which are not described in the specification. The reference numeral 26 has been corrected to reference numeral 28 (as part of a ring-shaped heater), while reference numeral 35 is a typographical error for reference numeral 36.

The drawings are objected to since reference numerals 52 and 50 have been used to designate the photoresist layer. The Applicants respectfully point out that reference numeral 52 has been used only to designate the aperture. The Applicants fail to find any designation of the photoresist layer by reference numeral 52.

The drawings are objected to because reference numeral 52 has been used to designate both an aperture and an ink droplet in Fig. 3E. The Applicants respectfully point out that, in Fig. 3E, the reference numeral 52 is pointed to an aperture and not an ink droplet.

The drawings are objected to for not showing the first and the second insulating material layer. The Applicants respectfully point out that throughout Figs. 1B~1L, both reference numerals 16 and 18 have been shown to designate the top and the bottom insulating material layer.

Objection To The Specification

The disclosure is objected to due to informalities on page 22.

Page 22, line 3, has been amended to alleviate the Examiner's objections.

Claim Rejections Under 35 USC §112

Claims 11-20 are rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

It is pointed out that claims 11 and 14 are unclear because it merges elements of the intermediate structure shown in Fig. 1L with the final structure shown in Fig. 3F.

The Applicants respectfully submit that point out that while Figs. 1A~1N are cross-sectional views illustrating the fabrication process for the present invention ink jet, Figs. 3A~3F are all the same figures similar to Fig. 1N. The purpose of Figs. 3A~3F is to illustrate the working or the functioning of the present invention inkjet device. Figs. 3A-3F are not shown to illustrate the fabrication process of the device.

The lack of antecedent basis informality in claim 13 has been corrected.

Claim Rejections Under 35 USC §103

Claims 11-12, 14-17 and 20 are rejected under 35 USC §103(a) as being unpatentable over Leban '171 in view of Mitani et al '648, Taub et al '442 and Hawkins et al '245. It is contended that Leban teaches the claimed invention except of a first insulating layer made of silicon dioxide at a thickness of at least 1000 Å, a funnel-shaped manifold in the substrate, a metal seed layer on the first photoresist layer, a nickel layer on top of the metal seed layer, the heater in the primary ink chamber being ring-shaped and the seed layer being either Ni or Cr. It is further contended that Mitani et al teaches the silicon dioxide insulating

layer between 10000 and 20000 Å thickness; Taub et al teaches funnel-shaped ink fill slots and Hawkins et al teaches an orifice plate wherein an Ni or Cr seed layer is formed over a substrate and then a plate layer of nickel is deposited over the seed layer.

The rejection of claims 11-12, 14-17 and 20 under 35 USC §103(a) based on Leban, Mitani et al, Taub et al and Hawkins et al is respectfully traversed.

The present invention, as clearly recited in independent claim 11, recites:

> "Claim 11. A thermal bubble inkjet head having off-shooter heaters and a rapid ink refill mechanism comprising:
>
> a silicon substrate ...;
>
> **a first and a second insulating material layer** of at least 1000 Å thick on said top and bottom surfaces;
>
> a funnel-shaped manifold formed in said ...;

two spaced-apart heaters formed on said first insulating material layer ...;

...;

...;

a first photoresist layer of at least 2000Å thick on top of said third insulating material layer;

a primary and an auxiliary ink chamber formed in said first photoresist layer in fluid communication ...;

..."

The Applicants respectfully submit that the key elements of the present invention, i.e. a first and a second insulating material layer of at least 1000 Å thick, and a photoresist layer of at least 2000 Å thick for forming a primary and an auxiliary ink chamber are not taught or disclosed by the four references cited by the Examiner. The Leban reference, while citing a barrier layer 48 which may be photolithographically formed into an ink injection chamber and a drop injection chamber, Leban does not teach the formation of a primary and an auxiliary ink chamber that are in fluid communication with each other and with the funnel-shaped

manifold. The Leban reference does not teach a funnel-shaped manifold at all, let alone one that is in fluid communication with the primary and the auxiliary ink chambers. The Applicants further submit that the funnel-shaped ink fill slots disclosed by Taub et al is of a completely different configuration which is itself an inkjet injector. The funnel-shaped ink fill slots of Taub et al are not in fluid communication with an ink chamber, let alone a primary and an auxiliary ink chamber. (See Taub et al, Figs. 4A~4F)

The rejection of claims 11-12, 14-17 and 20 under 35 USC §103(a) based on Leban, Mitani et al, Taub et al and Hawkins et al is respectfully traversed. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

Claims 13 and 18 are rejected under 35 USC §103(a) as being unpatentable over Leban, Mitani et al, Taub et al, Hawkins et al and further in view of Moon et al '027. It is further contended that Moon et al teaches a ring-shaped heater that is not taught by the other references.

The Applicants respectfully traverse the rejection of claims 13 and 18 under 35 USC §103(a) based on the four references and Moon et al.

As previously presented, the Applicants have shown that the basic structure of independent claim 1 is not taught or disclosed by the four references, either singularly or in combination thereof. Specifically, the formation of a primary and an auxiliary ink chamber in a photoresist layer that is in fluid communication with a funnel-shaped manifold. The Applicants therefore respectfully submit that the additional reference of Moon et al does not lend any additional weight in a §103(a) rejection.

The rejection of claims 13 and 18 under 35 USC §103(a) based on Leban, Mitani et al, Taub et al, Hawkins et al and Moon et al is respectfully traversed. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

Based on the foregoing, the Applicants respectfully submit that all of the pending claims, i.e. claims 11-20, are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version With Markings To Show Changes Made".

In the event that the present invention is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

Tung & Associates

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Reg. No. 31,311
Telephone: (248) 540-4040

RWT\kd

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In The Specification

Paragraph 0056 has been amended as follows:

0056 After the inkjet droplet 74 departs from the inkjet head 10, the bubble 76 collapses and moves downwardly forming a void 78, shown in Figure 3D. Simultaneously [within a short delay], the heater electrode 24, situated in the auxiliary chamber 42, is activated, i.e. by sending an electrical current therethrough to generate heat. A bubble 80 is thus produced. As bubble 80 enlarges while continuously heated by the heater electrode 24, it expands from the auxiliary chamber 42 toward the primary ink chamber 40 and thus, pushing ink supply 82 in a refill action into and thus resupply the primary chamber 40. The off-shooter mechanism, or off-center shooter mechanism, is thus named for the present invention inkjet droplet formation process.

In The Claims

Claim 13 has been amended as follows:

13. (Amended) A thermal bubble inkjet head having symmetrical heaters and a rapid ink refill mechanism according to claim 11, wherein said inkjet orifice is formed in close proximity to said [ring-shaped heater electrode] two spaced-apart heaters.

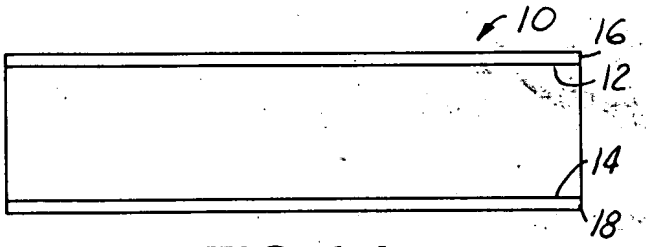

FIG. 1A

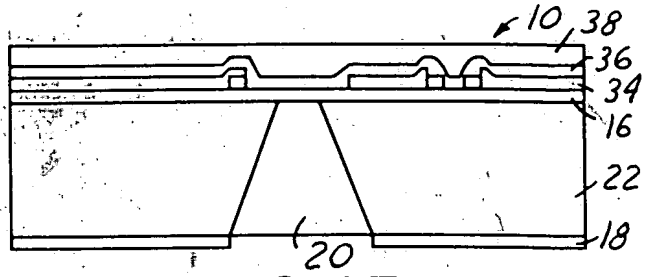

FIG. 1F

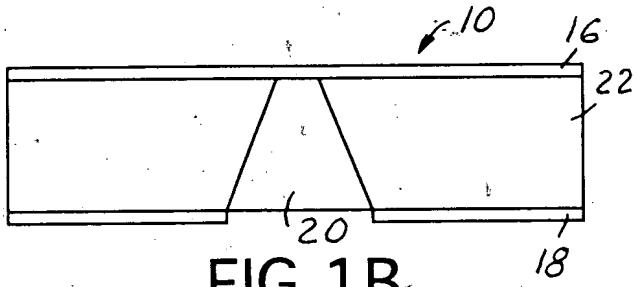

FIG. 1B

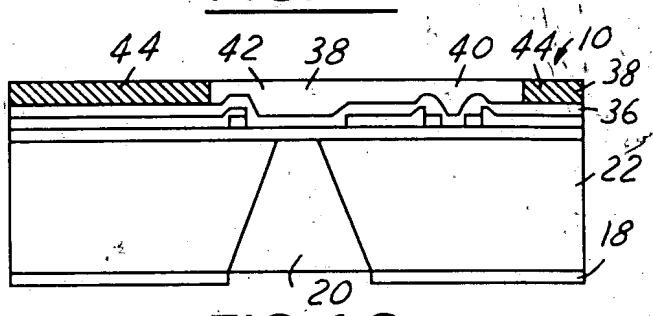

FIG. 1G

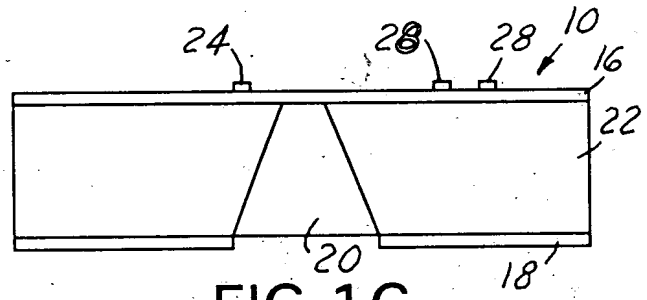

FIG. 1C

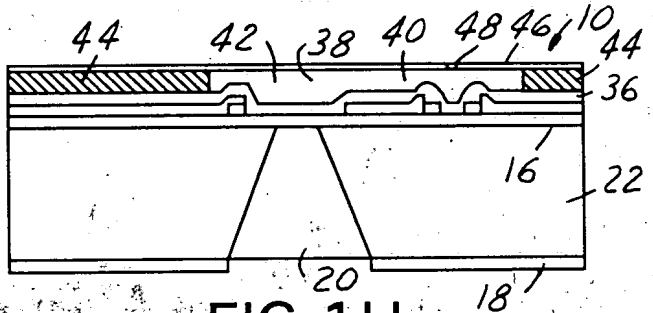

FIG. 1H

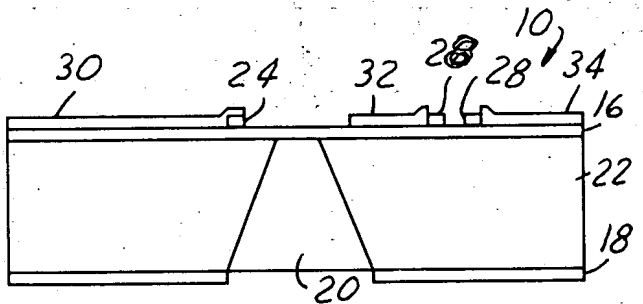

FIG. 1D

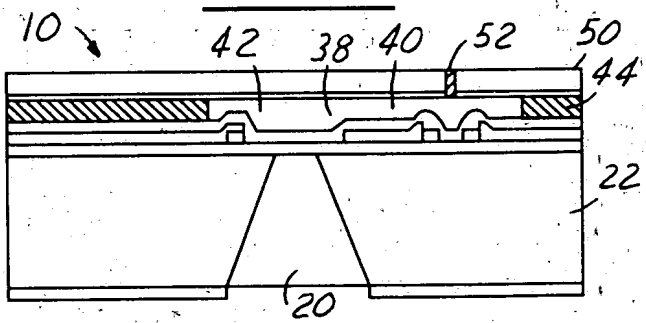

FIG. 1I

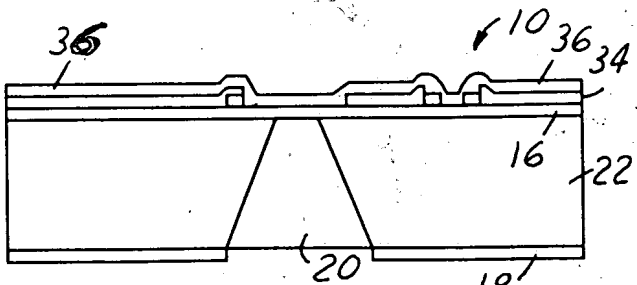

FIG. 1E

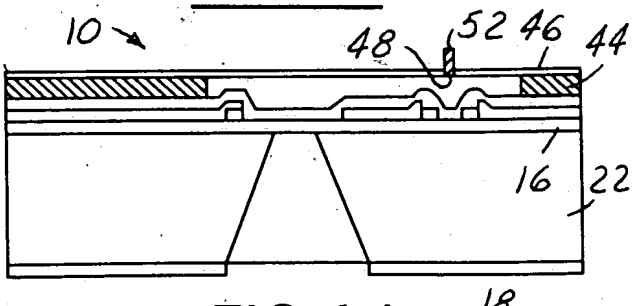

FIG. 1J

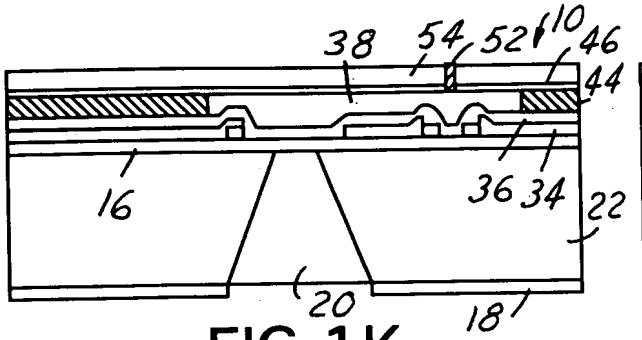

FIG.1K

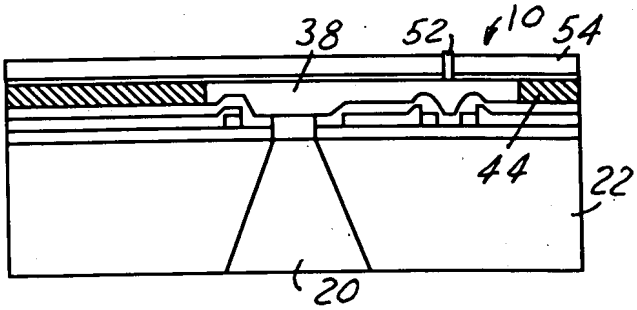

FIG.1M

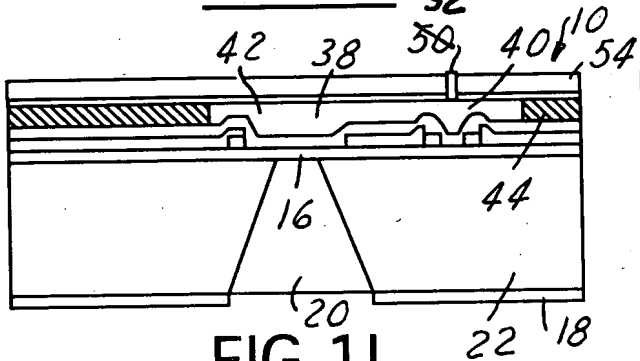

FIG.1L

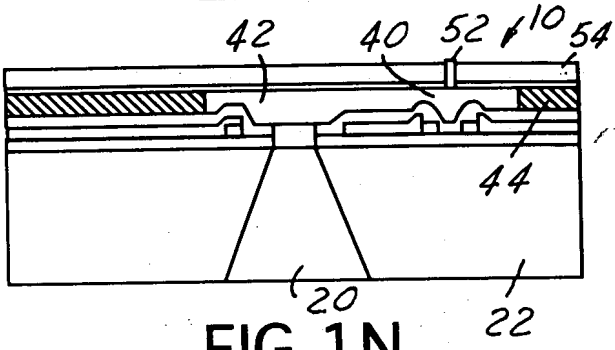

FIG.1N

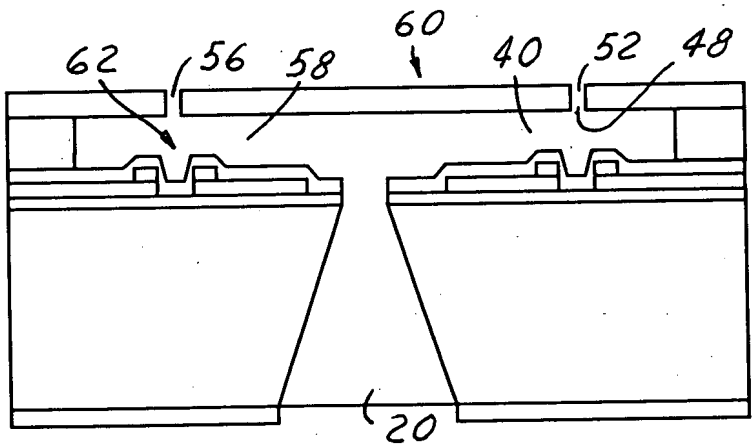

FIG.2